AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1-23. (canceled).

24. (new): A method for controlling an AC motor comprising

outputting an electric power to the AC motor, and

controlling an output current of an electric power converter based on a difference signal

of an output current detection signal and a current command signal of the electric power

converter, wherein

when the AC motor is in a free run condition, current control is conducted by forcing the

current command signal to be zero so that a current in the AC motor is made zero;

and wherein

an amplitude and phase and angular velocity of a residual voltage of the AC motor are

found based on a calculated output voltage command.

25. (new): The method of controlling the AC motor according to Claim 24,

wherein the phase and the angular velocity of the residual voltage are found from an addition

value of a phase command signal just before the free run of the motor and a phase signal of the

output voltage command.

26.   (new):   A method for controlling an AC motor comprising

outputting an arbitrary electric power to the AC motor;

detecting a current in the AC motor;

coinciding a given current command with the detected current;

switching an electric power converter based on a voltage command output from a current

control circuit,

wherein an amplitude and phase and angular velocity of a residual voltage of the AC

motor are found based on a calculated output voltage command

wherein the electric power converter is normally operated at a start, and a speed of the

AC motor in a free run condition is estimated.

27.   (new):   The method of controlling the AC motor according to Claim 24, wherein

a start control circuit forces the current command to be zero, and calculates the voltage command

that makes a detected current zero, and a speed of the AC motor is found by a time change of the

voltage command.

28.   (new):   The method of controlling the AC motor according to Claim 24, wherein

a start control circuit forces the current command to be zero, and calculates a voltage command

that makes a detected current zero, and when a voltage level of the motor is lower than a set

voltage level, after a DC current command is applied for a set time period from zero, the current

command is forced to be zero again, and the voltage command that makes the detected current

zero is calculated again, and the speed of the AC motor is estimated.

29.   (new): The method of controlling the AC motor according to claim 23, wherein,

the start control circuit forcibly sets the current command to be zero,

the output voltage command that makes the current detection signal to be zero is

calculated,

the current command is forcibly set to zero after a DC current control command is set to

a level for a time period when a voltage level is lower than a set voltage level,

further the output voltage command that makes the current detection signal to be zero is

calculated even when the voltage level is lower than a set voltage level, and

the speed estimation circuit estimates that the AC motor is stopped.

30.   (new): The method of controlling the AC motor according to any one of Claims

24 to 29, wherein the current command is made to be zero,

the voltage command by which a detected current zero is calculated, and

a speed is estimated by the time change of the voltage command, and

the AC motor is started by making the estimated speed of the AC motor and the

amplitude and phase of the voltage command as an initial value.

31.   (new): The method of controlling the AC motor according to any one of Claims

24 to 29, wherein the current command is made to be zero,

the voltage command by which a detected current is made zero is calculated, and

a speed is estimated by a time change of the voltage command, and

the AC motor is started by making the estimated speed of the AC motor and the

amplitude and phase of the voltage command as initial values and

an amplitude of the voltage command outputted from the electric power converter is

gradually increased until the amplitude reaches the voltage level corresponding to a normal

induced voltage at the speed of the AC motor.

32.   (new): A control apparatus of the AC motor, comprising

an electric power converter to output an arbitrary electric power to the AC motor;

a current detection circuit to detect a current supplied to the motor; and

a current control circuit which controls so that the given current command coincides with

the current detection value detected by the current detection circuit,

a start control circuit; and

a speed estimation circuit to estimate the speed of the AC motor in the free run condition,

wherein the switching of the electric power converter is determined from a voltage

command outputted from the current control circuit and

an amplitude and phase and angular velocity of a residual voltage of the AC motor are

found based on a calculated output voltage command.

33.   (new): A control apparatus of the AC motor according to Claim 32, wherein the

start control circuit forces the current command to be zero, and calculates the voltage command

that makes a detected current zero, and a speed of the AC motor is found by a time change of the

voltage command.

34.   (new): A control apparatus of the AC motor according to Claim 32, wherein the

start control circuit forces the current command to be zero, and calculates the voltage command

that makes a detected current zero, and

when a voltage level of the motor is lower than a set voltage level, after a DC current

command is applied for a set time period from zero, the current command is forced to be zero

again, and

the voltage command that makes the detected current zero is calculated again, and

the speed of the AC motor is estimated.

35.   (new): The control apparatus according to claim 32, wherein, the start control

circuit forcibly sets the current command to be zero,

the current control circuit is adapted to calculate the output voltage command that makes

the current detection signal to be zero,

and to forcibly set the current command is forcibly to zero after a DC current control

command is set to a level for a time period when a voltage level is lower than a set voltage level,

further current control circuit is adapted to set the output voltage command that makes

the current detection signal to be zero even when the voltage level is lower than a set voltage

level, and

the speed estimation circuit is adapted to estimate that the AC motor is stopped.

36.   (new): A control apparatus of the AC motor according to Claim 32, the current

command is made to be zero, the voltage command by which the current detection value is made

zero is calculated, and

a speed is estimated by a time change of the voltage command, and

the AC motor is started by making the estimated speed of the AC motor and the

amplitude and phase of the voltage command as initial values.

37.   (new): A control apparatus of the AC motor according to Claim 32, wherein the

start control circuit forcibly makes the current command zero, and the current control circuit

calculates the voltage command by which a detected current is made zero, and

a speed is estimated by the time change of the voltage command,

the AC motor is started by making the estimated speed of the AC motor and the

amplitude and phase of the voltage command as initial values,

the amplitude of the voltage command outputted from the electric power converter is

gradually increased until it becomes the voltage level corresponding to the normal induced

voltage at the speed of the AC motor.

38.   (new): The method of controlling an AC motor according to Claim 26, wherein

the start control circuit forces the current command to be zero, and calculates the voltage

command that makes a detected current zero, and

when the voltage command is larger than a set voltage level, the speed estimation circuit

estimates the speed of the AC motor by a time change of the phase of the voltage command, and

when the electric power converter is started, the amplitude and phase of the voltage

command and the frequency corresponding to the estimated speed of the AC motor are set as

initial values.

39.   (new): A method of controlling an AC motor comprising

outputting an electric power to the AC motor from an electric power converter, and

controlling the output current based on a difference signal of a current command signal

and a detected current signal of the electric power converter,

wherein when the AC motor is in the free run condition, an arbitrary DC current is

supplied to the AC motor for a set time period, and

a frequency component of the detected current signal of the electric power converter is

detected, and

a speed of the AC motor is estimated from the frequency.

40.   (new): The method of controlling an AC motor according to Claim 26, wherein

a start control circuit forces the current command to be zero, and calculates the voltage command

that makes a detected current zero, and

when a voltage level is lower than a set voltage level, a DC current command with a set

level or the DC voltage command with a set level is applied for a set time period from zero, and

a frequency component appearing in a detected current is estimated as a speed of the AC

motor, and

the frequency component is set as an initial value when the electric power converter is started.

41.   (new): The method of controlling an AC motor according to Claim 26, wherein a start control circuit forces the current command to be zero, and calculates the voltage command that makes a detected current zero, and

when the voltage command is lower than a set voltage level, a current command is changed from zero to a DC current command value with a set level, and supplied for a set time period, and

a sign and the amplitude of the current command are changed, and applied for a set time period.

42.   (new): The method of controlling an AC motor according to Claim 26, wherein a start control circuit forces the current command to be zero, and calculates the voltage command that makes a detected current zero, and

when the voltage command is lower than a set voltage level, a current control is stopped, and a DC current command is applied for a set time period in an arbitrary direction, and

an arbitrary amplitude current command is given in a direction in which a phase is changed by 180° from the command direction of the DC voltage, and the current control is conducted again for a set time period.

43.   (new): The method of controlling an AC motor according to Claim 26, wherein a start control circuit forces the current command to be zero, and calculates the voltage command that makes a detected current zero, and

when the voltage command is larger than a set voltage level, the speed estimation circuit estimates the speed of the AC motor by the time change of the phase of the voltage command, and

the amplitude and phase of the voltage command and the frequency corresponding to the estimated speed the AC motor are set as initial values and the AC motor started.

44.   (new): The method of controlling an AC motor according to Claim 32, wherein a start control circuit forces the current command to be zero, and calculates the voltage command that makes a detected current zero, and

when a voltage level is lower than a set voltage level, a DC current command with a set level or the DC voltage command with a set level is applied for a set time period from zero, and

a frequency component appearing in a detected current is estimated as a speed of the AC motor, and

the frequency component is set as an initial value when the electric power converter is started.

45.   (new): The method of controlling an AC motor according to Claim 32, wherein a start control circuit forces the current command to be zero, and calculates the voltage command that makes a detected current zero, and

when the voltage command is lower than a set voltage level, a current command is

changed from zero to a DC current command value with a set level, and supplied for a set time

period, and

a sign and the amplitude of the current command are changed, and applied for a set time

period.

46.   (new): The method of controlling an AC motor according to Claim 32, wherein

a start control circuit forces the current command to be zero, and calculates the voltage command

that makes a detected current zero, and

when the voltage command is lower than a set voltage level, a current control is stopped,

and a DC current command is applied for a set time period in an arbitrary direction, and

an arbitrary amplitude current command is given in a direction in which a phase is

changed by 180° from the command direction of the DC voltage, and the current control is

conducted again for a set time period.